

## Claims

- [1] An internal combustion engine comprising:
- a cylinder block having one or more cylinders;
  - a cylinder liner with a tubular shape, disposed inside said cylinder;
  - a piston reciprocating inside said cylinder liner and having a top land portion formed of an outer periphery of the piston sandwiched between a piston head and an uppermost ring groove; and
  - a liner installation ring forming a circular step portion inside the cylinder, and disposed in said cylinder block or said cylinder liner in such a manner that a bottom face of the liner installation ring faces to an uppermost portion of said cylinder liner, the circular step portion protruding to an inner periphery of said cylinder liner, wherein:
    - said liner installation ring is disposed at a position in accordance with a top end position of said top land portion when said piston reaches a top dead center; and
    - said liner installation ring is set to protrude from the inner periphery of said cylinder liner in an inward direction at a length of 0.05 mm or more to 0.5 mm or less.

[2] The internal combustion engine according to Claim 1, wherein:

- a circular projection is formed on the bottom face of said liner installation ring along an inner peripheral end thereof; and
- a groove portion is formed below said circular step portion, being sandwiched between the inner periphery of said cylinder liner and said projection.

[3] The internal combustion engine according to Claim 2, wherein:

- said projection is formed in a tapered shape, inclining downwards to the inside of the cylinder from a crosspoint of the bottom face of said liner installation ring and the inner periphery of said cylinder liner; and
- an angle that a tapered surface of said projection forms with the inner periphery of

said cylinder liner is in a range of 45 degrees to 60 degrees.

[4] The internal combustion engine according to Claim 1, wherein:

a circular notch is formed on an internal diameter side of a contact face of said cylinder block or said cylinder liner with said liner installation ring; and

a groove portion is formed below said circular step portion, being sandwiched between the bottom face of said liner installation ring and said notch.

[5] The internal combustion engine according to Claim 4, wherein:

said notch is formed in a tapered shape, inclining downwards from the contact face with said liner installation ring to the internal diameter side; and

an angle that the bottom face of said liner installation ring forms with a tapered surface of said notch is in a range of 45 degree to 60 degree.

[6] The internal combustion engine according to any one of Claims 1 to 5, wherein:

an external diameter of said liner installation ring is set to be larger than an external diameter of an uppermost portion of said cylinder liner; and

a latch step portion is formed in the upper portion of said cylinder of said cylinder block and latches said liner installation ring to restrain its downward movement.

[7] The internal combustion engine according to Claim 6, wherein:

the uppermost portion of said cylinder liner is positioned above the uppermost ring groove when said piston reaches the top dead center; and

the uppermost portion of said cylinder liner is disposed below said latch step portion with a distance.

[8] The internal combustion engine according to any one of Claims 1 to 7, wherein

said liner installation ring has open parts in a peripheral direction thereof which face to each other with a predetermined distance, in order to fix said liner installation ring on said cylinder block or said cylinder liner by tension of the open parts separating from each

other.

[9] The internal combustion engine according to any one of Claims 1 to 8, wherein  
a ring-side circular groove is formed in the inner periphery of said liner installation  
ring in a peripheral direction of the ring.

[10] The internal combustion engine according to any one of Claims 1 to 9, wherein  
a piston-side circular groove is formed in the top land portion of said piston in a  
peripheral direction of the piston.

[11] The internal combustion engine according to any one of Claims 1 to 8, wherein:  
a ring-side circular groove is formed in the inner periphery of said liner installation  
ring in the peripheral direction of the ring; and

a piston-side circular groove is formed in the top land portion of said piston in a  
peripheral direction of the piston in such a position to face to said ring-side circular groove  
when said piston reaches the top dead center.

[12] The internal combustion engine according to any one of Claims 1 to 11, wherein:  
a piston-side circular groove is also formed in a second land portion in the  
peripheral direction of the piston, the second land portion being positioned below the top  
land portion of said piston and the uppermost ring groove.

[13] The internal combustion engine according to any one of Claims 9 to 12, wherein  
a longitudinal section of at least one of said ring-side circular groove and said  
piston-side circular groove is V-shaped such that a top face thereof is horizontal or  
upwardly inclines to a bottom of the groove, and a bottom face thereof is tapered in such a  
manner that it goes away from the bottom of the groove as it goes downward.

[14] A liner installation ring to be applied to an internal combustion engine that  
comprises a cylinder block having one or more cylinders with a latch step portion in its/their  
upper portion(s), and a tubular cylinder liner disposed in said cylinder, the liner installation

ring being disposed in said latch step portion with its bottom face facing to an uppermost portion of said cylinder liner; while disposed, an inner peripheral end of the ring inwardly protruding from an inner periphery of said cylinder liner to said cylinder to form a circular step portion inside said cylinder, wherein

a length from a position of the inner periphery of the cylinder liner when said liner installation ring is disposed to the inner peripheral end of the disposed ring is set to be in a range of 0.05 mm to 0.5 mm.

[15] The liner installation ring according to Claim 14, wherein:

a circular projection is provided in the bottom face along the inner peripheral end of the ring;

said projection is formed in a tapered shape such that it downwardly inclines to the inner periphery of the ring from a position of the inner periphery of the cylinder liner when the ring is disposed; and

an angle that a tapered surface of said projection forms with the inner periphery of said cylinder liner is in a range of 45 degrees to 60 degrees.

[16] The liner installation ring according to Claim 14 or 15, wherein

the liner installation ring has open parts at a position in a peripheral direction of the ring, the open parts facing to each other with a predetermined distance.

[17] The liner installation ring according to any one of Claims 14 to 16, wherein

the liner installation ring has a ring-side circular groove in the inner periphery in a peripheral direction of the ring.

[18] The liner installation ring according to Claim 17, wherein

a longitudinal section of said ring-side circular groove is V-shaped such that a top face thereof is horizontal or upwardly inclines to a bottom of the groove, and a bottom face thereof is tapered in such a manner that it goes away from the bottom of the groove as it

goes downward.

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